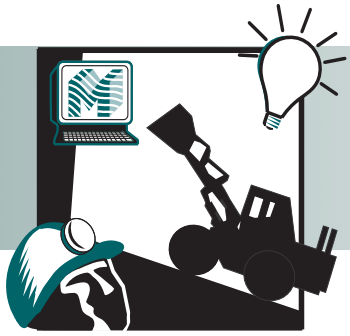
MINING

Project Fact Sheet



Alternative Anode Reaction for Copper Electrowinning

Benefits

- Improves energy efficiency by reducing power requirements for electrowinning by 50%.
- Improves worker safety and reduces maintenance costs by eliminating acid mist.
- Reduces carbon dioxide emissions by reducing electricity requirements.

Application

This project is to develop an alternative anode reaction that relies on the ferrous/ferric/sulfur dioxide (FFS) chemical species in the copper electrowinning. The FFS will extremely enhance the copper electrowinning process by reducing the energy consumption, lowering the operation costs, and improving the occupational health and worker safety.

Alternative Anode Reaction Will Lower Costs, Lower Emissions and Increase Efficiency

Solvent extraction/electrowinning (SXEW) is a growing segment of the copper industry, producing some of the best quality copper on the market. However, the conventional electrowinning of copper is a highly energy-intensive process and produces an acid mist that may be hazardous to both workers and equipment in the work environment. In the conventional copper electrowinning process, the anode reaction is the oxidation of water. This anode reaction generates gaseous oxygen, producing an acid mist that is highly corrosive to buildings, equipment, and creates a hazardous environment for workers.

In the proposed ferrous/ferric/sulfur dioxide (FFS) process, ferrous oxidation replaces the water oxidation. The overall cell voltage of FFS is half that of the conventional process. Also, no gas will be generated during this anode reaction. The results are that this alternative oxidation reaction will require up to 50 percent less energy for electrowinning and solve the problems caused by acid mist.

FFS allows for (1) energy savings during electrowinning, (2) lower operation costs, (3) increased environmental and safety benefits, and (4) compatibility with existing conventional solvent extraction operations. The FFS technology can be readily retrofitted to existing commercial copper electrowinning tank houses or incorporated into new installations.

Copper Anode

This project will develop an alternative anode reaction that relies on the ferrous/ferric/sulfur dioxide (FFS) chemical species in copper electrowinning.

Project Description

Objective: To (1) Conduct a pilot plant operation at a commercial copper electrowinning operation. The technical approach will be to develop a manifold and pump design that will enable an efficient anode reaction and demonstrate the viability of anode coatings and acid recovery systems. (2) Devise a process that will accomplish the following:

a) Produce SO_2 from sulfur.
b) Reduce ferric ions in copper electrolyte to ferrous ions using SO_2.
c) Emit less than 40 tons SO_2 /year from a 175,000 tons SO_2 /year production plant.
d) Provide a flowsheet, metallurgical balance, major equipment list and order-of-magnitude capital and operating costs for a plant producing 175,000ton/year copper.
e) This project will also provide an economic evaluation of the process to establish its advantage over the conventional electrowinning.

This technology can be readily retrofitted into existing commercial copper electrowinning tankhouses or incorporated into new installations. The technical approach will be to develop a manifold and pump design that will enable an efficient anode reaction and demonstrate the viability of anode coatings and acid recovery systems. The project will consist of three major phases: (1) laboratory scale experiments and modeling, (2) small-cell operation scale consisting of two commercial-size anodes and three full-sized cathodes with manifolds, and (3) a large pilot plant operation at a commercial copper electrowinning operation. This project will also provide an economic evaluation of the process to establish its advantage over conventional electrowinnings.

Progress and Milestones

Activities to be completed in this project include:

- Develop a manifold design that will provide the established flow characteristics.
- Design and demonstrate the sulfur dioxide reduction and acid recovery system
- Demonstrate the fully integrated process at large pilot plant scale.
- Provide an economic evaluation of this process versus the conventional copper electrowinning.
- Test reductants other than sulfur dioxide in the laboratory.

Commercialization Plan

This technology can be readily retrofitted into existing commercial copper electrowinning tankhouses or incorporated into new installations. Phelps Dodge, Newmont and ASARCO are three of the largest copper producing companies in the U.S. that use the electrowinning process. Their involvement in the project will assure that the technology will transferred to the U.S. copper electrowinning industry.

PROJECT PARTNERS

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